



California Regional Water Quality Control Board

San Francisco Bay Region



Terry Tamminen
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Arnold Schwarzenegger
Governor

February 13, 2004

Alexis Strauss
US EPA, WTR-1
75 Hawthorne St.
San Francisco, CA, 94105

Dear Ms. Strauss:

SUBJECT: SF Bay Mercury TMDL Report

We are in the process of revising the SF Bay Mercury TMDL staff report and proposed Basin Plan Amendment to clarify the scientific and regulatory basis of the proposed TMDL and address comments put forth in U.S. EPA's September 8, 2003 letter. The attachment contains a detailed response to U.S. EPA's comments and discusses additional work we intend to do to improve the TMDL.

We'd like to emphasize our intention to establish a scientifically sound and feasible TMDL that solves one of San Francisco Bay's most challenging water quality problems. The TMDL is designed to resolve impairment of San Francisco Bay associated with elevated mercury in fish consumed by humans, and concerns about wildlife exposure. The TMDL is intended to meet all State and Federal regulatory requirements, including requirements pertaining to establishing wasteload allocations and a margin of safety. We assert that attainment of the TMDL targets will result in attainment of applicable water quality standards, and that the adaptive implementation plan provides reasonable assurance that the targets will be attained. We intend to consult with U.S. EPA's NPDES staff while drafting final TMDL language to assure that the implementation plan is consistent with federal NPDES regulatory requirements.

In October 2003, we transmitted a draft staff report and proposed Basin Plan Amendment language to three technical peer reviewers. These draft documents are undergoing technical review, as required under State law, and we will share reviewers' comments with your staff as soon as they are available. We look forward to meeting with your staff and stakeholders to further discuss how to best implement the TMDL. If you have any questions, please feel free to contact me at (510) 622-2314 or contact Tom Mumley at (510) 622-2395.

Sincerely,


Bruce Wolfe
Executive Officer

Attachment

Preserving, enhancing, and restoring the San Francisco Bay Area's waters for over 50 years

**SYNOPSIS OF U.S. EPA COMMENTS
REGARDING THE JUNE 2003 SF BAY MERCURY TMDL PROJECT REPORT
AND WATER BOARD RESPONSES (indented)
January 30, 2004**

The EPA comment letter does not have page numbers, but it does contain two distinct parts – a cover letter (Cover Letter) from Alexis Strauss and an enclosure (Enclosure) that provides more detail on the comments. To help the reader locate the EPA comment to which a response is offered, each response concludes with the location of the comment in the EPA letter.

1. NARRATIVE WATER QUALITY STANDARDS

A. Bird Egg Target

The U.S. Fish and Wildlife Service and EPA are studying the effects of EPA's human health fish tissue criterion on threatened and endangered species. Preliminary results suggest that the proposed fish tissue target may not be protective of the most sensitive species. The proposed bird egg target is associated with toxic effects. The LOEC should be translated into a NOEC to ensure the protection of wildlife. [*The comment is located in the Enclosure under the section entitled, "1. TMDL Comments", in the paragraph beginning "Proposed Bird Egg Numeric Targets May Not Sufficiently Protect Beneficial Uses...."*]

Our fish tissue target is intended to protect humans who consume San Francisco Bay sportfish. Rather than revise this target to specifically protect wildlife, we propose a separate wildlife target and assert that the goal of the TMDL is to achieve all targets. We are proposing a bird egg mercury concentration target to protect wildlife based on the rationale that birds are the most sensitive wildlife receptor, and that bird egg concentrations are a direct measure of wildlife risk. We prefer this approach over modifying our fish target or establishing targets for the small fish that birds consume because we have very little information on mercury concentrations in prey fish, and determining appropriate prey fish mercury concentrations, or projecting how prey fish concentrations relate to sportfish, introduces additional uncertainties into the analysis.

We do agree that modifications to the bird egg wildlife target are appropriate. Our intention is to establish a wildlife target at which no adverse wildlife effects will occur, especially in rare and endangered species. We met with a USFWS representative and considered additional information that he and EPA have provided. Unfortunately, a mercury concentration for bird eggs for which there are no observable adverse effects (referred to as a NOEC) has yet to be determined. The USFWS, in their comments to EPA on the proposed human health fish tissue criterion, estimated a NOEC by dividing the lowest observable effects concentration (LOEC) by 3. While this approach may help put the fish tissue criterion in perspective, we expect that the LOEC will be redefined at a later date after more

studies are performed. Until such studies are completed, we propose establishing our wildlife target as an upper numeric concentration boundary with supporting narrative, which states that the intention of the wildlife target is no observable adverse effects. To address EPA's concerns regarding the bird egg wildlife target, we are revising the report as follows:

USFWS concluded that, if predatory fish at the top of the food web were to contain 0.3 ppm mercury (USEPA's criterion), most San Francisco Bay wildlife species would be protected. The one exception could be the California least tern. Based on a number of assumptions (e.g., nationwide mercury bioaccumulation data are representative of California estuarine food webs), USFWS concluded that the California least tern would be protected if mercury concentrations in top predator fish were to be 0.12 ppm or less. USFWS also concluded that mercury concentrations of about 0.03 ppm in smaller prey fish comprising the California least tern diet would be protective. (The California least tern generally consumes fish less than 5 centimeters long.) The mercury content of smaller fish more closely relates to California least tern mercury exposure than the mercury content of larger fish. Fewer assumptions are needed to derive the 0.03 ppm for smaller fish than the 0.12 ppm for larger fish. However, mercury concentration data for California least tern prey in San Francisco Bay are unavailable for comparison purposes.

California least tern egg mercury concentrations are a more direct measure of California least tern mercury risks than prey concentrations....

...[S]tudies support the conclusion that bird egg concentrations at or above 0.5 ppm could be associated with toxic effects, but they do not provide a specific concentration at which no toxic effects would occur. In the absence of this information, USEPA has suggested estimating a no-effects level by dividing 0.5 ppm by two or three. However, USEPA concluded that, because of the substantial uncertainties in estimating a no-effects level, neither two nor three can be considered the only correct value (USFWS 2003). Research is needed to develop a site-specific factor for San Francisco Bay or to determine a bird egg mercury concentration that corresponds to no adverse effects.

Because available information suggests that the bird egg mercury concentration at which no adverse effects would occur is below 0.5 ppm, a bird egg target of less than 0.5 ppm mercury (wet weight) and no observable adverse effects is proposed. This target will be refined when a mercury toxicity threshold for the California least tern or a more sensitive species are developed. The goal of refining the target would be to establish a level that reflects a concentration that fully protects beneficial uses. Such a refinement would protect all wildlife, including rare and endangered species that nest and feed in the vicinity of San Francisco Bay.

...For California least tern egg mercury concentrations to drop below 0.5 ppm, existing bird egg concentrations need to be reduced by more than 25%. A 40% reduction (roughly the same reduction required to meet the fish tissue target) would result in egg mercury concentrations of about 0.4 ppm. A 50% reduction would result in average egg mercury concentrations of about 0.3 ppm. .

The proposed allocation scheme for this TMDL calls for an overall reduction in mercury loads of about 50%.

B. Sediment Target

EPA's sediment quality guidelines recommend a Threshold Effects Level of 0.13 ppm, which is associated with no observed effect on benthic organisms. This value is slightly lower than the NOAA Effects Range-Low value for mercury. The TMDL sediment target should be no greater than 0.13 ppm. [*The comment is located in the Enclosure under the section entitled "1. TMDL Comment" in the paragraph beginning with "Proposed Sediment Numeric Target May Not..."*]

Our proposed suspended sediment target (0.2 ppm) is consistent with applicable standards (discussed under Section 2, below) and our fish and wildlife targets, and is intended to protect beneficial uses from bioaccumulation effects. The sediment guidelines EPA referenced are not water quality criteria. These guidelines were developed to guide decisions regarding cleanup of bedded sediments and toxicity to benthic organisms. We use, and will continue to use, these guidelines on a site-specific basis to guide risk-based cleanups at Bay-margin contaminated sites.

2. NUMERIC WATER QUALITY STANDARDS

A. Compliance With Numeric Aquatic Life Objective

The TMDL does not include current water quality standards as numeric targets. Moreover, the TMDL does not demonstrate how the numeric Basin Plan aquatic life objective or the CTR human health criterion would be attained. The sediment target ignores the potential for frequent exceedances of numeric water quality standards (~10% of the samples taken over the past 8 years would exceed the Basin Plan objective). [*These comments are located in the Cover Letter in the section entitled "Compliance with Numeric Water Quality Standards" and in the Enclosure in the section entitled "TMDL Comments".*]

Numeric targets interpret water quality objectives. TMDLs are not required to contain numeric water quality objectives as numeric targets. Proposing the Basin Plan objective as a target could distract from the goal of target development, which focuses on bioaccumulation effects.

The rationale for considering the Bay to be impaired is not based on exceedances of numeric water quality objectives; it is based on fish consumption advisories and wildlife risks. The Project Report does not make a case that the Basin Plan and

CTR water quality objectives (WQOs) are exceeded. In other words, pursuant to CWA § 303(d)(1)(A) and 40 CFR § 130.7(b), the Bay has been identified as impaired because existing controls are not stringent enough to implement the narrative WQO against bioaccumulation. Hence, under the CWA this TMDL is required to address that impairment. Data do not show impairment based on numeric WQOs, and the Bay has not been formally listed as impaired as to these standards; therefore, no TMDLs to attain these standards are required for submittal to EPA under CWA § 303(d)(1)(C). Of course, as required under CWA § 303(d)(1)(C) and 40 CFR § 130.7(c), this TMDL addressing bioaccumulation must be established at levels necessary to attain and maintain the applicable WQOs, including numeric ones, and the proposed TMDL does so – this TMDL is consistent with and will ensure maintenance of all applicable WQOs.

There are three applicable water column numeric objectives that we have considered: the Basin Plan 0.025 µg/l mercury water column concentration (averaged over a four-day period) which was established to protect against bioaccumulative impacts to human health; the Basin Plan 2.1 µg/l mercury water column concentration (averaged over one-hour) to protect against acute toxicity; and the CTR 0.051 µg/l mercury water column concentration (averaged over an appropriate time period, only applies to the Lower South Bay) which was established to protect against bioaccumulative impacts to human health). We propose revising the report to clarify that the targets are consistent with these three numeric water quality objectives as follows:

The Basin Plan objective of 0.025 µg/l (averaged over a four day period) is derived from the U.S. Food and Drug Administration's action level for mercury in commercial fish and shellfish, 1.0 ppm, based on the relative methylmercury concentration found in the Eastern oyster compared to the total mercury concentration in water the Eastern oyster lives in (USEPA 1985). Because the proposed fish tissue target of 0.2 ppm is substantially lower than the U.S. Food and Drug Administration action level of 1.0 ppm, it is consistent with the lowest applicable numeric objective.

The sediment target is also consistent with the numeric objectives. Under existing conditions the Basin Plan one-hour average total mercury objective of 2.1 µg/l has never been exceeded in any RMP sample collected in San Francisco Bay (SFEI 2003b). Therefore, because reaching the sediment target will require reductions in existing sediment mercury concentrations, attaining the target makes exceedances of the objective even less likely.

We assert that attainment of the sediment target will result in attainment of 4-day average and CTR objectives. We agree to conduct a more thorough analysis of RMP data to support this assertion.

B. Local Effects

The TMDL analysis describes how mercury discharges could be causing local exceedances of water quality standards in the vicinity of discharge locations and other points in the Bay. This concern should be addressed by modifying the individual wasteload and load allocations to ensure attainment of the numeric water quality standards at the individual discharge locations. *[The comment is located in Cover Letter in the section entitled “Compliance with Numeric Water Quality Standards.”]*

The TMDL does not describe how mercury discharges could be causing local exceedances of water quality standards in the vicinity of discharge locations in the Bay. We are not aware of evidence that such exceedances occur. Therefore, we do not deem it appropriate to modify the proposed individual wasteload and load allocations in the manner suggested by EPA.

The TMDL may not protect against local exceedances of the applicable water quality standards, which may be significant in terms of ecological impacts. The TMDL acknowledges the potential that local near-field effects of mercury discharges may be significant at some locations. The document cites a recent study that suggests that the input of wastewater into the southern portions of the Bay could be an important contributor to mercury methylation through the supply of organic carbon and nutrients. There is also evidence that wastewater from point sources often contains a relatively higher fraction of dissolved mercury and methylmercury that could be more bioavailable than mercury from nonpoint sources. Further, equally comparing contributions from sediment and other sources potentially conceals local impacts of point source dischargers. *[These comments are located in the Enclosure at the end of a paragraph beginning with “TMDLs May Not Result In Attainment of Applicable Standards Throughout The Bay... .”]*

Available information does not support a quantitative distinction between the mercury bioavailability and mercury sources. The implementation plan requires all controllable sources, including wastewater dischargers, to study the potential for local effects and relative bioavailability. If point source discharges are shown to disproportionately contribute to mercury bioaccumulation effects, such new information will be incorporated into the TMDL through the adaptive management process described in the TMDL implementation plan.

We are not aware of evidence that suggests that water mercury concentrations anywhere in the Bay have ever exceeded the water quality standard relevant to short-term ecological impacts: the Basin Plan’s 1-hour average water quality objective of 2.1 µg/l mercury, which is intended to protect against acute effects, has never been exceeded in any RMP sample. Note that both the CTR value and the Basin Plan 4-day average relate to protection of human health and not ecological effects. As previously discussed, there is no evidence that the Basin Plan’s 4-day average of 0.025 µg/l is violated, although individual grab samples have exceeded this concentration. The averaging period for the CTR value of 0.051 µg/l mercury is a long-term period related to bioaccumulation in fish, so it is not clear that it has been

violated. Thus, the only water quality objective that relates to ecological impacts is the 1-hour average, which has never been violated in the 465 RMP grab water samples analyzed between 1993 and 2000.

The TMDL acknowledges the *possibility* for local effects either at the point of discharge or other locations in the Bay. However, we are not aware of any evidence that such effects currently exist. The TMDL calls for investigations into this issue to determine whether such effects exist, and if studies suggest that there are localized effects, the TMDL will be revised accordingly to eliminate such effects. This is part of the adaptive management framework detailed in the implementation plan. In addition, the proposed implementation plan includes provisions for wastewater to monitor and report exceedances of concentration-based triggers, and specifies follow-up actions to remedy such effects, if they do exist. Based on EPA's comments, we are considering including concentration-based effluent limitations derived from the Basin Plan's one-hour average mercury concentration of 2.1 µg/L to protect against toxic effects in the vicinity of discharge.

The paper cited regarding wastewater discharged into southern portions of the Bay is not evidence of a localized effect due to wastewater treatment. The authors of the paper merely speculate that wastewater treatment plants may be the source of this bioavailable mercury and dissolved organic carbon, but they do not provide evidence that this is the case. There is likewise no evidence that the mercury from wastewater treatment plants is more bioavailable than mercury from other sources. While it is possible that this is the case, it is also possible that it is less bioavailable. Because there is currently only speculation and not evidence of either local effects or exceedance of ecologically relevant water quality objectives in the vicinity of discharge locations, our approach is sound. It is appropriate to impose concentration-based triggers on wastewater discharges and to investigate the possibility of local effects. However, based on the current state of knowledge concerning local effects, we deem it not appropriate to modify load allocations in the manner suggested by USEPA. Again, we are not allowing wastewater discharges to increase either their mass or concentrations above existing conditions. If, in the future, evidence points to the presence of such effects or exceedances of ecologically relevant water quality objectives, we will modify the load and wasteload allocations in an appropriate fashion.

3. WASTE LOAD ALLOCATIONS

A. Individual Allocations

EPA states that the report is unclear as to whether there will be individual WLAs for individual industrial, municipal wastewater, and municipal storm water permittees. [*The comment is located In the Cover Letter in a section entitled "Individual Waste Load Allocations."*]

The Project Report provided individual WLAs for urban runoff management agencies (Table 7.2), municipal wastewater dischargers (Table 7.3), and industrial wastewater dischargers (Table 7.4). These WLAs will be included in the proposed Basin Plan Amendment.

B. Daily Loads

EPA agrees that loads do not need to be expressed as daily loads if there are reasons why another time period is more appropriate; however, no explanation is given in the TMDL for not using daily loads. *[The comment is located in the Enclosure in the section entitled “TMDL Allocations” in a paragraph beginning with “A Rationale for Not Expressing Allocations As Daily Loads...”]*

TMDL regulations provide that TMDLs “can be expressed in terms of either mass per time, toxicity, or *other appropriate measure*.” 40 CFR § 130.3(k) (emphasis added). Thus, the TMDL does not have to be expressed solely as a daily load. The second sentence in the Project Report, page 42, states the rationale for using yearly loads: because bioaccumulation is a long-term process and the loads are intended to represent long-term averages and account for long-term variability. We are clarifying the text as follows:

A TMDL need not be stated as a daily load. Other measures are allowed if more appropriate. The allocation scheme proposed below is expressed in terms of annual mercury loads in kilograms per year (kg/yr) because bioaccumulation is a long-term process. The loads are intended to represent long-term averages and account for long-term variability, including seasonal variability.

C. Wastewater Allocation

The TMDL exempts municipal and industrial dischargers from reducing mercury loads because it might cost too much. EPA believes point sources that can reduce their discharges in a cost-effective way should do so. The fact that other sources are the dominant cause of impairment does not eliminate the need for feasible pollution prevention. *[The comment is located in the Enclosure in the section entitled “II. Implementation Plan Comments” in a paragraph beginning with “Pollution prevention and control strategies ...”]*

The TMDL regulations require that sources be reduced to achieve targets. The regulations do not specify that all sources need to be reduced. Bay Area municipal wastewater treatment plants operate at a high performance level. Over the last two decades, municipalities have invested a considerable amount of funds in order to significantly reduce pollutant loads and implement effective pollution prevention programs. As a result, Bay Area plants discharge a relatively small amount of mercury to the Bay on an annual basis. Over 60% of Bay Area plants provide secondary treatment. Their median effluent concentration is about 14 ng/l. Almost 40% of Bay Area plants provide advanced treatment. Their median effluent

concentration is about 5 ng/l. Together, municipal and industrial facilities are responsible for less than 2% of all mercury entering the Bay. We have not proposed to require additional treatment because further reduction currently appears to be unjustified. Additional controls would not be cost-effective considering the limited environmental benefit. If future studies show that wastewater mercury is disproportionately responsible for adverse mercury effects (either because these discharges are more bioavailable or contribute to local effects), then the proposed WLAs may be changed through the adaptive management process described in the implementation plan. In any case, we do intend to require pollution prevention.

D. Bioaccumulation Weighting Factor

Consider applying a “weighting factor” to sediment sources that is less than that applied to “new” sources. [*The comment is located in the Enclosure in the second paragraph of the section entitled “Sediment As a Mercury Source.”*]

We would apply a weighting factor if supported by available information. We are considering this scenario as part of our alternatives analysis. However, currently available information is insufficient for us to propose a quantitative weighting factor.

4. NPDES PERMITTING

A. Numeric Water Quality Based Effluent Limits (WQBELs)

The TMDL implementation provisions provide for triggers in lieu of WQBELs. WQBELs must be numeric unless infeasible. [*The comment is located in the Cover Letter at the beginning of the section entitled “Concerns About NPDES Permitting Provisions.”*]

WQBELs can be numeric or narrative, or a combination of numeric and narrative requirements. We are not proposing triggers in lieu of WQBELs. We propose issuing a mercury-specific NPDES watershed permit to wastewater dischargers that implements the wasteload allocations. This permit would include a mass load numeric WQBEL equal to the aggregate wasteload allocation. We would also include a number of narrative provisions, as we do with our existing permits. For added protection, we are proposing numeric concentrations that will trigger certain narrative requirements. Alternatively, we are considering use of the individual WLAs as triggers. We believe this approach to WQBELs is acceptable and desirable, particularly in the context of solving a complex water quality problem. We will engage USEPA and stakeholders in development of permit specifications including consideration of individual numeric limits along with incentives and credits for offsets and protection against unwarranted enforcement. We propose to conduct this effort in parallel with moving forward with the proposed TMDL package.

B. Averaging Period

The proposed 5 year averaging period is inconsistent with the numeric objective and NPDES regulations, which require monthly, daily, and weekly time frames, unless impracticable. EPA recommends using rolling 12-month annual averages to assess long-term compliance because it would provide for both short and long term compliance timeframes. Monthly or weekly averaging periods could account for shorter-term fluctuations and ensure compliance with applicable numeric standards. *[The comment is located in the Cover Letter in the section entitled “Averaging Period for Municipal and Industrial Dischargers is Too Long” and in the Enclosure in the section entitled “II. Implementation Plan Comments” in the subsection entitled “Averaging Period for Municipal and Industrial Dischargers is Too Long.”]*

The proposed load allocations and implementation strategy are intended to address bioaccumulation, a long-term effect. We are not aware of evidence suggesting that mercury directly threatens the Bay’s aquatic life (short-term effects). A rolling 12-month average is not necessarily better than a 5-year average for estimating long-term effects. We propose evaluating progress towards achieving TMDL targets on a five-year basis because the longer time allows us to account for naturally occurring inter-annual variability in mercury loads. Nevertheless, as discussed in our response to issue 5.A below, we know that resulting WQBELs must be consistent with applicable WLAs and their basis and associated assumptions. Obviously, the averaging period of an effluent limit must be consistent with the WLA. We will also consider the practicality of converting an annual WLA into a shorter averaging timeframe using effluent limit derivation guidance. We propose to work with USEPA and stakeholders to identify appropriate NPDES permit language.

C. Pollution Prevention

The document is unclear regarding whether pollution prevention plans will be required only after triggers are exceeded or as a requirement in all NPDES permits. *[The comment is located in the Enclosure in the section entitled “II. Implementation Plan Comments” in the paragraph beginning with “Pollution Prevention Plans”]*

We intend to require all NPDES permittees to implement pollution prevention programs. We propose that the following requirements be incorporated into NPDES permits:

- Develop and implement effective mercury source control programs to minimize significant mercury sources (the level of effort will be commensurate with the discharge volume of the facility).
- Track individual facility and aggregate wastewater loads and the status of source control and pollution prevention activities.

D. Point Source Allocations

EPA recommends wastewater WLAs be based on (1) current performance or (2) the applicable numeric water quality objective multiplied by facility flow, whichever is more stringent. EPA’s

analysis concluded that only 2 of 24 dischargers do not meet the applicable numeric WQO at the discharge point when their discharge results are averaged over the long term. More than 90% of municipal discharges comply with EPA's recommended allocations. EPA found that, on average, industrial dischargers meet applicable numeric standards. EPA concluded that, since mercury loads from the POTWs are higher than mercury loads from industrial dischargers, most industrial dischargers would comply with EPA's recommended allocations. EPA concludes that adoption of its recommended allocations would necessitate no treatment upgrades by almost all dischargers. [*The comment is located in the Cover Letter in the section entitled "Compliance with Numeric Water Quality Standards."*]

Our proposed allocations are based on current performance and, in sum, these allocations are more stringent than if they were derived using the applicable water quality objective. The proposed allocation for wastewater is 17 kg per year (based on current performance, see response under issue 5.A for further discussion of current performance and calculation of wasteload allocations). If all wastewater discharged to the Bay had a mercury concentration equal to the Basin Plan objective of 25 ng/L, the mercury load would be about 22 kg/yr. If all wastewater discharged to the Bay had a mercury concentration equal to the CTR value of 51 ng/L, the mercury load would be about 44 kg/yr.

EPA proposes that in 2 out of 24 cases, individual allocations should be lowered to a load equal to the applicable numeric water quality objective multiplied by facility flow. However, we see no reason to use an inconsistent scheme to assign WLAs to different dischargers, and our linkage analysis supports our assertion that biological uptake of mercury is driven by the mass of mercury in the system and process that enhance the methylmercury production. In the few cases where **effluent** concentrations may occasionally exceed the 4-day average numeric objective or CTR value for **receiving waters**, the mercury load is inconsequential in light of the entire TMDL. (Mercury loads are more relevant to bioaccumulative effects than concentrations.) Most importantly, the implementation plan calls for each wastewater discharger to "conduct studies to evaluate the presence or potential for local effects on fish, wildlife, and rare and endangered species in the vicinity of wastewater discharges." If specific discharges are found to threaten local beneficial uses, allocations may be changed through the adaptive management strategy described in the implementation plan.

E. Non-Point Source Allocations

EPA recommends an analogous approach to non-point source load allocations (i.e., express allocations on a short term and long term basis). [*The comment is located in the same location as the previous comment regarding wastewater sources.*]

We believe it is unreasonable, due to the nature of the discharge, to require urban runoff to meet the same requirements as wastewater. Specifically, it is unreasonable to monitor short-term mercury concentrations in urban runoff because urban runoff mercury concentrations fluctuate substantially with flow and other

conditions. In addition, tracking compliance with short-term limits would be infeasible. The goal of urban runoff load reduction measures is to reduce long-term effects (bioaccumulation).

5. POTENTIAL ALLOWANCES FOR GROWTH

A. Wastewater Load Increases

Because the proposed WLAs are based on a very long averaging period, setting the WLAs based on the 95th percentile would have the effect of permitting increases in long-term mercury loads compared to current average performance. No other allocation is derived this way. [*The comment is located in the Cover Letter in the section entitled “Potential Allowances for Growth in Point Source Discharge” and in the Enclosure in the section entitled “TMDL Allocations” in the paragraph beginning with “Allowances for Growth in Point Sources Prior to Nonpoint Source Reductions... .”*]

The EPA comment suggests that the reviewer may have misunderstood that the 95th percentile is used solely for the statistical purpose of expressing the likelihood that wastewater sources are currently discharging at the identified level. The TMDL does not allow for growth in any source category. The load estimates for wastewater are based on approximately two years of monitoring information. The data within this period are robust and sufficient to produce a reasonable estimate of the wastewater mercury load, and its variability, for the two years measured. However, the two-year period is relatively short in terms of Bay Area climatic variability. Climatic variability can affect mercury loads by affecting mercury concentrations and flows. Using an upper percentile of the data distribution ensures that we do not understate the true long-term central tendency of the mercury loading that would be computed if a monitoring data set representing a longer period were available. Therefore, we estimated current wastewater loads as the 95th percentile load (mean + [1.64485 x standard deviation]) to ensure that we have a robust, long-term estimate of annual loads that accounts for variability both in effluent mercury concentration and volumetric flow of wastewater effluent as a result of climatic or other variability. No other allocation is derived this way because the data for other sources are insufficient for this approach. The statistical validity of this approach is something we expect our scientific reviewers to comment on. We will share their comments with you when they are available. In the meantime, we will review available data, including more recent performance data and evaluate whether other statistical approaches should be considered. Ultimately, we will ensure that the basis of the WLAs is clear and sound. We will also ensure WQBELs that implement the WLAs are applied in a manner consistent with the basis of the WLAs.

B. Available Assimilative Capacity

Allowing increases in point source loads is inappropriate until assimilative capacity is available. The TMDL does not demonstrate that allocated load reductions are practicable or that they will

be implemented prior to allowing increases. [*The comment is located in the Cover Letter in the second paragraph of the section entitled “Potential Allowances for Growth In... .”*]

As previously discussed, we are not proposing an increase from the wastewater category. Compared to existing mercury loads and the proposed allocations, any possible increases from an individual facility would be negligible. Such minor increases, if they were to occur, would have to be offset by decreases from other facilities and done in a manner as to not cause localized effects.

We believe the proposed implementation plan is feasible and adequately supported. The implementation plan is set up so that it can be adapted as necessary to assure that necessary load reductions and measures to minimize methylation are implemented.

C. Reasonable Assurance for Guadalupe River

The Guadalupe River reductions are significant (>95%). No explanation is provided for how this will be achieved. [*The comment is located in the Enclosure in the section entitled “TMDL Allocations” in a paragraph beginning with “The Analysis Provides No Reasonable Assurances that...”*]

The Guadalupe River watershed is identified as a substantial contributor of mercury to the Bay, and a separate TMDL effort is underway for which resources have been dedicated. Mercury reduction measures for the Bay TMDL will be identified through the Guadalupe River TMDL process. We assert that the foregoing constitutes sufficient reasonable assurance that the load allocations will be implemented. Mercury concentrations in this watershed are relatively high as a result of mining. Significant progress has been recently made in controlling mining sources and, as a result, we believe that substantial reductions are reasonably likely. The Project Report describes reasonable actions on pages 58 and 59. The Guadalupe River TMDL is tasked with achieving its allocation and possibly reducing loads further if deemed appropriate. If load reductions are later deemed infeasible, the Bay TMDL will be revised accordingly.

6. MARGIN OF SAFETY

A. Implicit Margin of Safety

The TMDL should discuss each and every important source of analytical uncertainty and the approach taken to ensure an implicit margin of safety to account for them. The TMDL analysis does not sufficiently discuss analytical uncertainties associated with background loads; meeting water quality standards in the Bay as a whole versus attainment throughout the Bay; meeting standards over the long term, resulting in short term exceedances; and declining bed erosion loads. [*The comment is located in the Cover Letter in the section entitled “Insufficient Margin of Safety” and in the Enclosure in the Section entitled “Margin of Safety.”*]

The Project Report acknowledges where available information is limited. A TMDL need not catalog every source of uncertainty. More importantly, a conservative assumption is not required for each source of uncertainty. The TMDL need only rely on enough conservative assumptions to ensure that an implicit margin of safety is provided. We are convinced that our margin of safety is adequate, and we are expanding the discussion of the margin of safety in the Project Report. We believe our commitment to adaptively manage TMDL implementation also provides an implicit margin of safety.

B. Unknown Sources

Local mines and sites along the Bay margins are not given allocations. EPA recommends a reserve allocation or an explicit margin of safety. [*The comment is located in the Enclosure in the section entitled “TMDL Allocations” in a paragraph beginning “Several Sources Are Not Accounted For...”*]

If additional sources, such as Bay margin sites or mine sites are discovered, the TMDL will be revised accordingly. Since we’re not certain that these potential sources actually contribute mercury to the Bay, there is no basis on which to select allocations. Since explicit allocations are not provided, the implicit allocations are 0 kg/yr. If these sources were discovered to be contributing appreciably to mercury in the Bay, providing an explicit margin of safety would not help the situation, as EPA suggests, because these sources would not be entitled to loads withheld for the margin of safety. Including these potential sources in the implementation plan even though they have not been confirmed does contribute to the margin of safety.

C. Margin of Safety

Consider including an explicit margin of safety (perhaps 10-20%) in the TMDL to account for uncertainty. [*The comment is located in the Enclosure near the end of the section entitled “Margin of Safety.”*]

EPA has offered no basis for assuming any particular explicit margin of safety. No specific number is supported by available information. To select a margin of safety of 10 or 20% would be arbitrary. There is no way to be sure whether such a margin of safety would account for the uncertainties EPA has listed. The Water Board cannot make decisions that are arbitrary. Nevertheless, the report does provide evidence that our analysis is conservative. As shown in Figure 7.2, the proposed allocations will likely result in an average sediment mercury concentration of roughly 0.15 ppm, which is 0.05 ppm below the proposed target of 0.2 ppm. Therefore, we believe that the implicit margin of safety will result in a tangible margin of safety.

D. Linkage Analysis

The assumed 1:1 relationships among mercury levels of different media may not be conservative.

[The comment is located in the Enclosure in the first paragraph of the section entitled “Margin of Safety.”]

We assume that reducing mercury sources will result in concomitant reductions in sediment, fish tissue, and bird egg mercury concentrations. Available information sufficiently supports this assumption, at least from the Bay-wide perspective, and no one has offered a better one. The proposed allocations are based on this assumption. To the extent that TMDL implementation reduces mercury methylation and bioaccumulation, less mercury source reduction may be needed. Therefore, basing the allocations on the assumed 1:1 relationship may require more load allocations than necessary. In this sense, the assumption is conservative.

E. Fish Consumption

Using local fish consumption data reflects the best available information, but it does not guarantee that the fish tissue target is conservative. *[The comment is located in the Enclosure in the third paragraph of the section entitled “Margin of Safety.”]*

The fish tissue target is conservative. We not only used local consumption data, but we made two assumptions that are more conservative than those EPA used in developing its criterion: (1) we selected the 95th percentile of consumption, and (2) we included consumption data representing a relatively small, highly exposed portion of the Bay Area population, not all Bay Area residents. EPA’s consumption rate represents the 90th percentile of the entire U.S. population, not just those who choose to consume fish.

F. Human Health Criterion

Using EPA’s method to calculate a human health criterion is not necessarily conservative just because EPA used conservative assumptions. The safety factors used in all reference doses represent the risk uncertainty in all human health criteria guidance. They do not represent a conservative assumption applicable to this particular TMDL. *[The comment is located in the Enclosure in the fourth paragraph of the section entitled “Margin of Safety.”]*

Because EPA’s human health criterion was developed using conservative assumptions, our target, which uses the same method, is also conservative. The safety factor associated with the reference dose accounts for sources of uncertainty in the calculation of the reference dose. Our TMDL can rely on such conservative assumptions for its margin of safety.

G. Wildlife Criterion

The fact that an EPA wildlife criterion for mercury in fish tissue is on the same order of magnitude as the TMDL’s human health target is not conservative. Moreover, the wildlife values are taken out of context. Those values depend on a set of assumed BAFs that may or may not apply to San Francisco Bay. The values were never intended to be wildlife criteria. They are

simply fish tissue values that one would get when the water-based criterion value of 50 pg/l is multiplied by mean BAFs, which were based in turn upon a survey of field data. [*The comment is located in the Enclosure in the fifth paragraph of the section entitled “Margin of Safety.”*]

The fish tissue target is not intended to protect wildlife; it is intended to protect human health from fish consumption. Nevertheless, our proposed fish tissue target of 0.2 ppm, which applies to trophic level 4 fish, is lower than the value EPA calculated (0.346 ppm in fish) using a water column concentration of 50 pg/L and mean bioaccumulation factors (BAFs). We believe this supports our conclusion that our approach is conservative. The use of BAFs based on nationwide data is not ideal, but it is consistent with the approach U.S. FWS used to evaluate the extent to which EPA’s fish tissue target protects wildlife (see item #1B above). We are revising the “margin of safety” text for clarity:

USEPA calculated fish mercury concentration values necessary to protect wildlife using a water column concentration of 50 pg/L and mean bioaccumulation factors (BAFs) (USEPA 1997d). The calculated fish tissue mercury concentrations were 0.077 ppm for small fish and 0.35 ppm for larger predator fish that humans more typically consume. The TMDL fish tissue target proposed to protect human health, 0.2 ppm, is substantially lower than EPA’s estimated 0.35 ppm.

H. Conservativeness of Recovery Model

The model may overstate the degree to which existing sediment is a source. The model results would be different using different source and loss inputs for sediment and dredging. A greater dredging loss value would result in a steeper set of curves, while a small sediment source value would lower the initial height of the curves. Together, these would tend to accelerate the projected date that the Bay would attain water quality standards. Nevertheless, overstating sediments as a source does not excuse allowing other sources to not reduce their discharges. [*The comment is located in the Enclosure in the section entitled “III. Other Comments.”*]

Our model represents our best attempt to simplify a complex system. The model inputs are our best estimates of the relative contributions of the various sources. The simplicity of the model offers the ability to identify and prioritize reasonable actions without over-interpreting available data. The Bay may recover faster than we predict if our model incorporates conservative assumptions. An adequate margin of safety could result in a somewhat faster recovery. Nevertheless, due to the simplicity of the model and our desire not to over-interpret its limited results, we have chosen not to highlight how any potential margin of safety may relate to the speed of recovery.

7. RECOVERY MODEL

A. Model Validation

The recovery model is not ground-truthed with past data. Even though contaminated sediment has been (theoretically) already escaping under the Golden Gate, water quality has not changed. A plan to monitor and verify input values and assumptions should be provided. [*The comment is located in the Enclosure in the section entitled “III. Other Comments.”*]

The Project Report (page 50) warns against over-interpreting the model’s simple conclusions. We developed the model only to demonstrate (1) that assuming the proposed allocations will result in target attainment is reasonable and (2) that recovery will take a long time. To ground-truth the model against past data, we would need information on sediment and mercury inputs that correspond to particular points in time when in-Bay sediment mercury concentrations are known. We would also need relevant fish tissue data. Available data, however, are inadequate to ground-truth the model. Moreover, relevant fish tissue data are unavailable. The implementation plan includes provisions to verify important data and assumptions used in the analysis.

B. Bed Erosion

It appears that as sediment is flushed out through the Golden Gate, more contaminated sediment may be exposed. If so, water quality may get worse, rather than better, in the near term. [*The comment is located in the Enclosure in the second paragraph of the section entitled III. Other Comments.*]

We don’t believe bed erosion is occurring uniformly across the horizontal surface of the Bay floor (if it were, mercury concentrations would probably get higher before they got lower). We believe bed erosion is primarily occurring vertically as the sides of channels erode, thereby averaging the eroding mercury concentrations at different depths. Because local hydrodynamic processes vary, suspended sediment mercury concentrations may increase at some locations while decreasing at others. Detailing local bed erosion and accretion is impractical within the context of this TMDL; our goal is to provide a general picture of the Bay that integrates local conditions and illustrates the net effect.

C. Active Layer

Sediment as a source may be overstated. The mass of mercury in the “active layer” subject to continuous resuspension (“bed erosion”) is assumed to be completely available for methylation and food web uptake. Even though about 75% mercury is particle-bound, the dissolved portion (about 25%) is more available for methylation and uptake. When mercury-laden particles settle in depositional locations, they may become more subject to methylation (especially those that become buried a few centimeters deep), but this is a surface area issue, not a sediment volume

(total mass of mercury) issue. Where sediment deposition is active, much of the mercury mass will be buried sufficiently so that methylation potential is relatively low compared to surface sediments (much less compared to the dissolved fraction or mercury from “new” sources). Remaining sediment in the “active layer” will generally be oxic and much less susceptible to methylation and uptake than the mercury from “new” sources. [*The comment is located in the Enclosure in a subsection entitled “Sediment As a Mercury Source” of the section entitled “III. Other Comments.”*]

This comment suggests confusion regarding the concepts of “bed erosion” and “active layer.” Bed erosion is the net effect of deposition and erosion along the floor of the Bay. It currently appears that more sediment is transported out of the Bay than is imported to the Bay. The overall result is that the Bay floor is dropping in more areas than it is rising.

The active layer is the layer of sediment along the Bay floor that mixes well with sediment in the water column. Hydrodynamic forces and the activity of benthic organisms are responsible for mixing the sediment in the active layer with suspended sediment. Therefore, the suspended sediment mercury concentration reflects the mercury concentration of new sediment entering the Bay and sediment being suspended via natural processes. The depth of the active layer varies. For mercury TMDL purposes, we assumed that the depth is 0.15 meters. In areas where new sediment is deposited on the active layer, portions of the active layer are buried (by virtue of our assumption, the active layer is always 0.15 meters, so the mercury concentration in the new active layer reflects the newly deposited sediment). In contrast, in areas where sediment is eroding from the active layer, previously buried sediment becomes within 0.15 meters of the surface, thereby becoming part of the active layer.

This comment appears to suggest that much of the mercury in the active layer is relatively unavailable for methylation and bioaccumulation. Nevertheless, by definition, the active layer is an area where sediment is well mixed. While at any particular instance the sediment toward the bottom of the active layer may not experience ideal methylating conditions, this sediment mixes with sediment closer to the surface, where the potential for methylation is greater. This comment may suggest that the assumed depth of the active layer is too deep, but the comment does not offer an alternative assumption. If the average depth of the active layer is less than assumed, then the Bay may respond more rapidly to the proposed load reductions. The proposed adaptive management strategy will entail studying the active layer and the relative importance of “new” mercury.

D. Golden Gate Loss

EPA is concerned about the uncertainty associated with losses through the Golden Gate. The TMDL should include a plan to monitor sediment loss via the Golden Gate. [*The comment is located in the Enclosure in a section entitled “Uncertainty of Losses Through the Golden Gate.”*]

The proposed adaptive management strategy will entail studying sediment transport. We will consider new information as it becomes available.

E. Dredging Losses

Dredging as a loss of mercury, both in the near future and in the long run, is understated. The report only reflects maintenance. Much more is removed from the Bay each year, and in future years the volume will increase. The report does not reflect the LTMS. The report does not account for the more highly contaminated dredged sediment that fails in-Bay disposal tests. [*The comment is located in the Enclosure in a subsection entitled “Dredging and Mercury Loss From the System” of the section entitled “III. Other Comments.”*]

Our report focuses on maintenance dredging because most dredged material is associated with maintenance. Channel deepening is not routine. In the last few years, special projects have constituted a relatively small portion of the sediment removed from the Bay. Future special projects cannot be anticipated. Available information does not suggest that the volume of material dredged from the Bay is going to increase substantially.

Whereas the loss of Bay sediment due to maintenance dredging is expected to continue unchanged, the volume of dredged material diverted from in-Bay disposal is expected to increase pursuant to the LTMS. There is currently a net mercury loss due to dredging and disposal, and the net loss will increase with the LTMS, as described on page 68 of the Project Report. According to our modeling assumptions, the benefits of increasing the net loss associated with dredging and disposal are limited to accelerating target attainment, not meeting targets. As reflected in the recovery curve discussion on pages 49 to 51 of the Project Report, disposing of dredged material outside the Bay reduces the amount of sediment that would otherwise exit through the Golden Gate due to the steady-state assumption explained in Section 3 of the Project Report.

To the extent that special projects might occur, they can be deeper and cleaner than maintenance dredging. For example, channel deepening removes sediment below what we’ve assumed is the active layer (15 cm). Channel deepening typically goes to depths well below the enriched mercury layer. Such activity removes sediment that is below (outside) the “box.” If disposed of in the Bay, this sediment could increase the dredging source term for mercury. In the event that a special project could occur and involve high-mercury sediment, that sediment would most likely be disposed of out-of-Bay. The TMDL analysis is conservative in ignoring this potential loss. Because future special projects cannot be anticipated, we have chosen not to highlight any potential margin of safety that such projects could provide.